A SIMPLE APPROACH TO IDENTIFY CRITICAL SOURCE AREAS FOR PHOSPHORUS LEACHING. VALIDATION ON DUTCH AND DANISH SITES

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High soil phosphorus contents in agricultural soils in the Netherlands cause excessive losses of P to surface waters. The reductions in P application rates in the present manure policy are not sufficient to reach surface water quality standards resulting from the European Water Framework Directive in all catchments by 2015. Accordingly, additional measures have to be considered to further reduce P loading to surface water. For a cost effective implementation of these measures an instrument to identify critical source areas for phosphorus leaching is indispensable. In the Netherlands phosphorus leaching at a national scale is simulated with a comprehensive mechanistic simulation model (STONE, Wolf et al., 2005) focusing on changes in P leaching with time. The identification of critical source areas requires simulations at a high spatial resolution. STONE is less suitable for this purpose, because of the large number of input parameters required by this complex model. For this reason, a simple model (PLEASE: Phosphorus LEAching from Soils to the Environment; Schoumans et al., in prep.) has been developed based on the same mechanistic process description for inorganic P as the complex model STONE and a simplified description of the lateral flow of water from soil to surface waters. With this model P leaching to surface waters can be calculated using readily available information of field characteristics like depth of the groundwater table, precipitation surplus and P status and phosphorus adsorption capacity of the soil. To evaluate the performance of the model, it was applied to a number of sites in the Netherlands and Denmark. For 8 sites in the Netherlands the model could be validated on measured P leaching fluxes for the other sites validation was limited to a validation of measured and simulated concentrations in lysimeter cups, drainwater or piezometers. The validation showed that for most sites the model was able to rank sites from low to high concentrations and from low to high leaching fluxes. Definition between measured and simulated results may be due to the simplification and assumptions in the model and the fact that for example generic sorption characteristics were used for most sites. Strong underestimations of the expected leaching fluxes were found for eutrophic peats soils and (clay) soil with shrinkage cracks. Eutrophic peats soils often release large amount of phosphorus from the subsoil. In clay soils shrinkage cracks may lead to substantial P losses due to transport of P through macropores to drains and surfacewater. These processes are not included in this simple model.

Wolf, J. et al. (2005), The integrated modeling system STONE for calculating nutrient emissions from agriculture in the Netherlands. Environmental Modeling and Software 18, 597-617.
Schoumans, O.F., P. Groenendijk and C. van der Salm (in prep.). PLEASE: A simple procedure to determine P losses by leaching